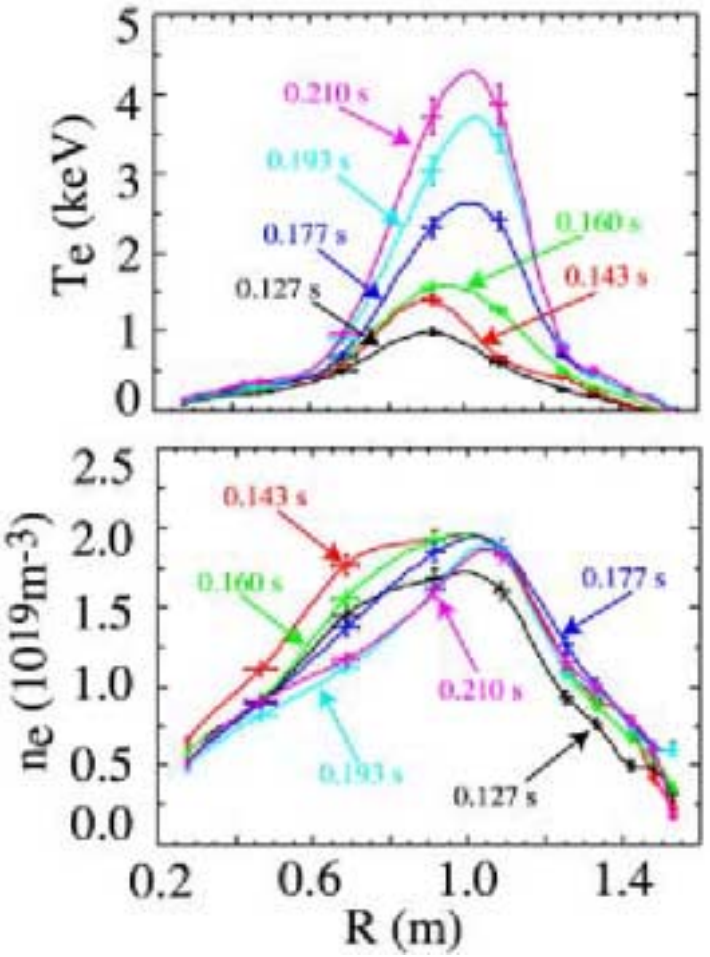
Session V Summary
Wave - Fast Ion - Plasma

Y. Takase

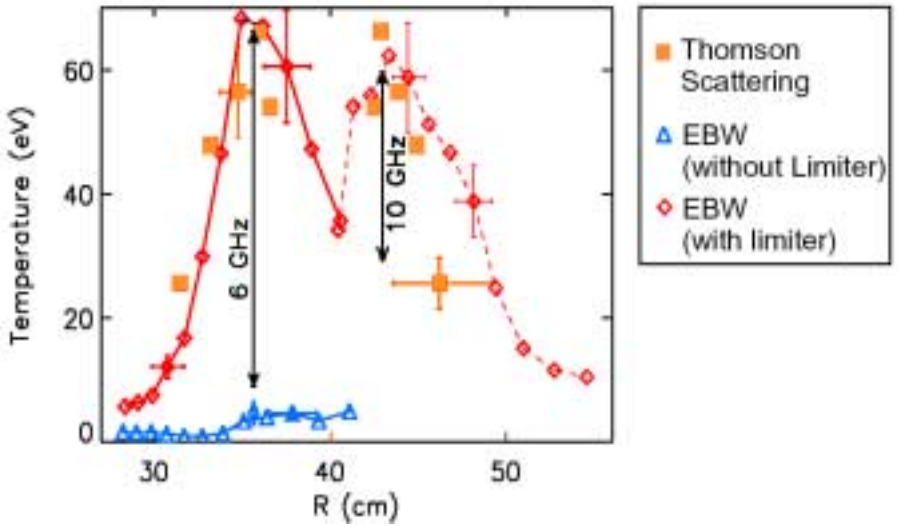
HHFW H&CD

- HHFW absorption
  - Determine absorption efficiency, power deposition profile
  - Ion damping (abs. by beam ion): more electron damping at higher β ?
- HHFW CD
  - ~100kA driven current inferred (NSTX)
  - Document current drive efficiency, controllability
- Bootstrap current generation by electron heating
  - ~40% I_{BS}/I_p (NSTX)
- ITB formation by HHFW heating?



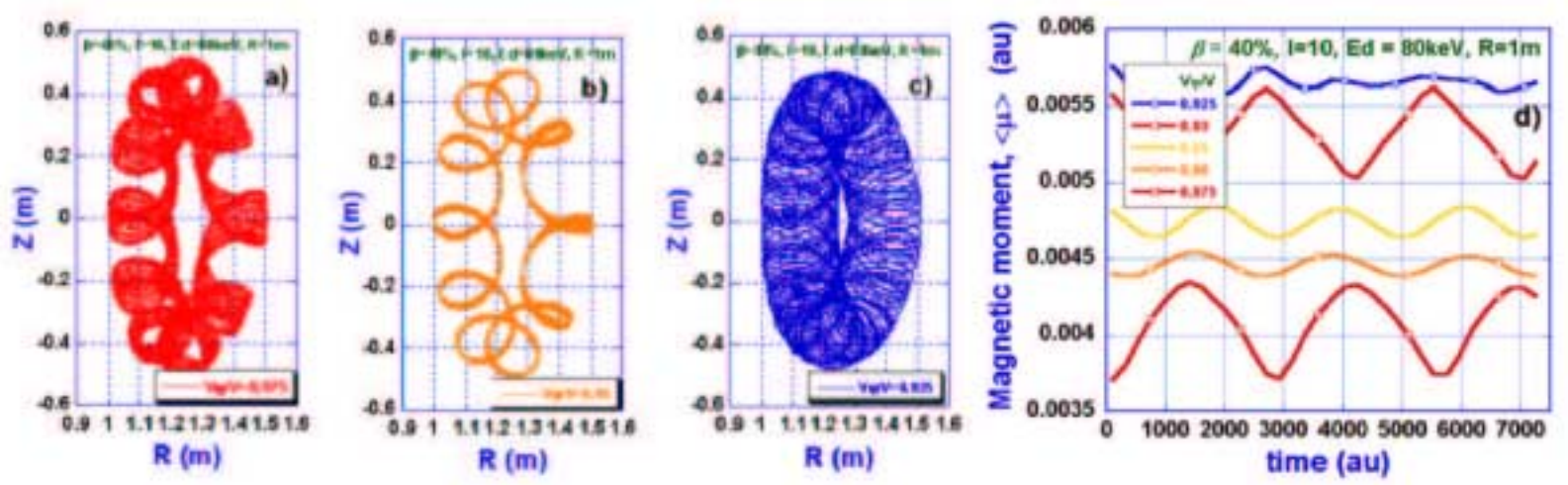
EBW H&CD

- Mode conversion efficiency
  - ~100% with local limiter (CDX-U)
  - Up to 50% in NSTX so far (higher MC efficiency to be demonstrated)
  - Direct measurement by reflection (TST-2)
- EBW CD
  - EC/EBW start-up and CD (LATE)
  - Direction control by poloidal launch angle
  - Good localization for NTM stabilization up to $\beta < 20\%$
  - Edge absorption for $\beta > 40\%$?
- Best scenario for H&CD to be determined
  - EBW H&CD experiment starting in MAST
  - Tube development may be necessary



NB H&CD

- NB fast ion confinement
  - Fast ion confinement classical in quiescent plasmas
  - Large orbit size, nonadiabatic ion motion (μ not constant)
  - Successful heating with counter NBI (MAST)
- NBCD
  - I_{NB}/I_p = 20-30% (MAST)
  - I_{NB}/I_p = 20%, I_{BS}/I_p = 40% (NSTX) 60% noninductive



Energetic Particle Driven Instabilities and Fast Ion Loss

- Anisotropy in fast-ion pitch angle distribution drives CAE and GAE
  - At low n ($2 < n < 7$) GAE (shear Alfven, center) $\omega/\omega_{ci} = 0.3\text{-}0.4$
  - For higher n ($n > 7$) localized CAE (edge)
- Fast ion losses: up to 20% in NSTX
  - TAE burst + fishbone
  - Fishbones: frequency chirping and periodic bursting (n up to 5)
    - mode amplitude largest in the core
  - Fast ion loss by ones that chirp to low frequency
- Energy channeling (fast ions → thermal ions) by GAE/CAE?
- Need to develop basis to extrapolate to future ST, ITER, etc.